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Sealing device

Technical Field

The present invention relates to a sealing device or apparatus for sealing packages containing a product. The sealing apparatus is to be mounted as a part of a larger packaging machine, which fills packages with products or substances, preferably food or beverages but could be any other suitable substance, then closes and seals the packages using the sealing apparatus by folding each package transversally, thereby closing it and sealing the transversal fold, and subsequently delivers the packages to a final folding station.

Moreover, the present invention also relates to a method used by the sealing apparatus/device for sealing the packages.

Description of the Prior Art

In a packaging apparatus, such as an apparatus for packages containing a fluid, preferably liquid or food of different kinds, it is of importance that the transversal sealing of the package is leakproof. The sealing is performed after folding of the package.

The sealing of the package depend on several parameters, e.g. the type of packaging material used in the package, the thickness of the packaging material , etc., which in turn affect the folding of the transversal joints to be sealed on the package.

This means that the folding of the transversal joint has to be done with sufficient or close tolerances, e.g. by aligning the folding and sealing equipment so that they correspond to each other and do not counteract, and/or by holding/supporting the package firmly during

folding and subsequent sealing so that the package is held in place and is formed or folds as desired.

US-4 546 592 discloses an apparatus for sealing a liquid package made of paper coated with plastic, the apparatus includes a pair of extending fingers for flattening the top edge of the package with the folded seam strip. The fingers are insertable in the open end of the package and driven for an extending movement. The apparatus also comprises a pair of welding jaws fixed to pivoted levers. The fingers and their actuation means are mounted above the package.

A disadvantage with US-4 546 592 is that wear of moving parts may create a bigger risk of having material on the fingers and their actuation means coming loose and falling down into the package before it is folded and sealed. Moreover, lubricants or any other contaminations may also fall into the open end of the package before sealing, thereby contaminating or polluting the package and any substance or product contained in the package. This gives a lower quality concerning hygienic requirements for the package and the apparatus.

Another problem is that the movable parts are difficult to disassemble or dismount from each other due to a complicated structure, whereby any maintenance and cleaning of the sealing apparatus are difficult and time-consuming creating a higher cost per package and/or product and a shorter working life for the apparatus.

Summary of the Invention

The main objects of the present invention are to fold and seal packages by using a novel sealing apparatus and a novel method of operating the sealing apparatus with a simpler, faster, more hygienic, and more reliable transversal folding and sealing of the packages.

These objects are achieved by an apparatus for sealing a package having an open end, the apparatus comprising at least one pair of halves reciprocally

movable between an open position and a closed sealing position for sealingly closing the open end of the package. The apparatus further comprising a pair of forming flaps, wherein each forming flap is associated with a sealing jaw and pivotally attached with a first end to a support such that a second end of each forming flap is adapted to at least partly follow the reciprocal movement of the associated sealing half. The forming flaps during the movement of the sealing halves towards the closed sealing position press two opposing portions of the package towards each other.

These objects are also achieved by an apparatus for sealing a package having an open end, comprising: at least one sealing equipment for sealingly closing the open end having the at least one pair of reciprocally movable sealing halves; and at least one actuation arrangement, wherein the sealing equipment or sealing means and the at least one actuation arrangement are operatively connected to each other. Moreover, the at least one sealing equipment or sealing means comprises at least one sealing device. The at least one sealing device comprises at least three pairs of linkage arrangements including a first linkage arrangement for pressing on opposing portions of the package at a distance from the open end thereof, a second linkage arrangement for holding or gripping each package, and a third linkage arrangement for sealingly closing the open end of the package.

Moreover, these objects are achieved by a first method for sealing a package, which method uses the above-mentioned apparatus. The method comprises the following steps: providing the apparatus according to the invention with a pair of forming flaps; setting the apparatus in a first open package receiving position; supplying a package to the apparatus; associating each forming flap with an associated sealing half of the at least one pair of reciprocally movable sealing halves;

moving the at least one pair of reciprocally movable sealing halves towards and into contact with the package; pressing two opposing portions of the package towards each other by means of the pair of forming flaps during the movement of the at least one pair of reciprocally movable sealing halves; biasing the at least one pair of sealing halves further by pressing against opposing portions of the package; thereby folding the opposing portions of the package; and sealing the package by supplying energy to the at least one pair of reciprocally movable sealing halves.

Furthermore, these objects are achieved by a second method for sealing the package having the open end by using the above-mentioned apparatus according to the invention. The method comprising the following steps: sealingly closing the open end of the package by using at least one sealing equipment having the at least one pair of sealing halves; providing the apparatus with the at least one actuation arrangement; operatively connecting the sealing equipment and the at least one actuation arrangement; providing the at least one sealing equipment with at least one sealing device; and providing the at least one sealing device with at least three pairs of linkage arrangements, a first linkage arrangement for pressing the package at a distance from the open end of the package on opposing portions, a second linkage arrangement for holding/gripping each package, and a third linkage arrangement for sealingly closing the open end.

By providing a packaging apparatus with a sealing apparatus according to the invention and operating the sealing apparatus by the suitable above-mentioned method, the following main advantages are obtained: the folding and sealing of each package are performed more accurately and easier, thereby reducing adjustment time and giving increased productivity; cleaning of the sealing apparatus is performed easier, faster, and better, whereby the

package and its content is kept sterilized creating a higher shelf-life for the package and its contained substance; and, the sealing apparatus is easier to disassemble or dismount and maintain, thereby also giving increased productivity.

Brief Description of the Drawings

The present invention will now be described in more detail with reference to the enclosed drawings, in which:

Fig. 1 shows a general assembly of a sealing device/apparatus to be mounted in a large packaging machine (not shown),

Fig. 2 illustrates a first package engaging device,

Fig. 3 shows a second package engaging and holding device,

Fig. 4 shows a third package engaging and sealing device,

Fig. 5 shows a drive equipment for the sealing device/apparatus in fig. 1,

Fig. 6 shows a front view of an actuation or operation part of the drive equipment in fig. 5,

Fig. 7 shows a view from the other side of the actuation or operation part in fig. 5,

Fig. 8 shows a view of a pivotable T-shaped device facilitating the sealing of packages from a first angle,

Fig. 9 shows a view of the pivotable T-shaped device in fig. 8 from a second angle, and

Fig. 10 shows a plan view of the pivotable T-shaped device in figs. 8 and 9 from another angle.

Detailed Desription of the Invention

Fig. 1 shows an apparatus 10 for sealing packages 20 (partly shown in figs. 8-10) according to the present invention. This apparatus 10 is to be mounted as a part of a larger packaging machine (not shown), which fills packages 20 with products or substances, preferably food or beverages but could be any other suitable substance,

then closes and seals the packages using the sealing apparatus 10 by folding an open end 20a of each package, thereby closing the open end and sealing the fold, and subsequently delivers the packages to a final folding station (not shown). The packages are transported into the sealing apparatus 10 from left to right in fig. 1 and out of the sealing apparatus after being sealed according to the three arrows in fig. 1, two arrows to the left in fig. 1 and one arrow to the right in fig. 1. The large packaging machine and its function will not be explained in more detail in this description because its function and structure is common knowledge for a skilled person.

Each of the packages 20 are handled upside down and transported into the sealing apparatus 10, each package has its first open bottom end 20a (shown in figs. 8-10) pointing upwards in the vertical direction and a second top end 20b (not shown) pointing downwards in the vertical direction.

Fig. 1 illustrates a general assembly showing all the parts, equipments and arrangements required for the operation of the sealing apparatus 10 except for the means required for connecting and fastening the sealing apparatus to the large packaging machine (not shown).

The sealing apparatus 10 shown in fig. 1 comprises two primary sections, a first upper section 30 with an equipment 40 for sealing the packages 20 and a second lower section 50 with a driving or operation equipment 60 for operating or actuating, i.e. move the sealing equipment 40. The upper sealing equipment 40 and the lower drive equipment 60 are separated by a middle section 70 of a frame 80 forming a partition between these two operating equipments 40 and 60.

The object of the middle section 70 of the frame 80 in fig. 1 separating the sealing equipment 40 from the drive equipment 60 is to ensure that the packages 20, and, more specifically, the open end 20a of each package and the content, i.e. the air and substance or fluid

contained in the package, are kept clean, hygienic, and sterilized by not being exposed to any contaminations created by the drive equipment, e.g. lubricants, dust, dirt, or even solid particles created by wear between the moving parts of the drive equipment, which particles otherwise somehow could end up in the packages by being transported, in this case, first upwards and then into the packages (not shown).

The packages 20 are kept hygienic and sterilized by supplying a sterile air flow constantly downwards from the top of the sealing apparatus 10 in fig. 1 through the apparatus and out adjacent the middle section 70 of the frame 80, so that any contaminations are kept away from each package and its open end 20a and urged out with the sterile air flow out of the sealing apparatus, this is also facilitated by the structure of the sealing apparatus because all of the lubricants and most of the moving metal parts are placed below the packages 20, or more specifically under the middle section 70 of the frame 80.

The upper sealing equipment 40 shown in fig. 1 uses two pairs of sealing devices 90, each pair 90 having two movable mirror-inverted arrangements 100 and 110 in the form of linkage arrangements. This adds up to two linkage arrangements 100 to the right in fig. 1 and two linkage arrangements 110 to the left in fig. 1. Here, in fig. 1, only one half 100 of the two movable mirror-inverted linkage arrangements 100 and 110 in the nearest sealing device pair 90 is shown in its entirety to the right for clarity reasons. The other nearest linkage arrangement half 110 to the left is only partly shown, i.e. only the parts directly engaging each package 20 (not shown) are shown. Each pair of sealing devices 90 is attached to the frame 80, the nearest pair in fig. 1 is attached at one side of the frame and is more clearly seen, the other pair is attached on the other side of the frame 80.

Each of the four linkage arrangements 100 and 110

being partly and/or entirely shown in fig. 1 has three armlike or leglike linksystems 120, 130, and 140. Each of these linksystems has different functions, and is shown in more detail on figs. 2-4. The first link system 120 shown in fig. 2 will hereinafter be referred to as a headspace device comprising two halves both shown in fig. 1, a first right head space half 150 and a first left head space half 160 for controlling the filled volume in the headspace of each package 20. The first right half 150 of the headspace device 120 is shown in fig. 1 and 2, the other first left half 160 (partly shown in fig. 1 but excluded in fig. 2) of the headspace device is placed opposite the first right half 150, as shown in fig. 1.

The second link system 130 shown in detail in fig. 3 will hereinafter be referred to as a forming tool comprising a first right forming tool half 170 and a first left forming tool half 180, the first left forming tool half 180 (partly shown in fig. 1 but excluded in fig. 3) of the forming tool 130 is placed opposite the first right forming tool half 170. The third link system 140 shown in detail in fig. 4 will hereinafter be referred to as a sealing jaw comprising a first right sealing jaw half 190 and a first left sealing jaw half 200 (partly shown in fig. 1 but excluded in fig. 4), which are placed opposite each other.

The functions and how one pair of the sealing devices 90 with its two linkage arrangements 100 and 110, i.e. the nearest pair of sealing devices in fig. 1, is operated or actuated will be explained later on in this description. The other pair of the sealing devices 90 beyond the first pair and the frame 80 operates and is actuated and constructed in the same manner as the first nearest pair of the sealing devices and is therefore not explained in detail.

The sealing equipment 40, i.e. each of the link/arm systems 120, 130, and 140 is in communication with, or, more specifically, connected to the drive equipment 60 by

means of at least four actuation linkage systems for moving the link/arm systems 120, 130, and 140 in relation to each other, the sealing apparatus 10 as a whole, and the packages 20 to be sealed. The drive equipment 60 comprises two primary drive devices, a cam curve disc 210 with associated parts and couplings connected to each of the link systems 120, 130, and 140 by means of inter-connecting devices for moving them, and an actuation device 220 separately connected to the third link system, i.e. the sealing jaw 140, for an additional biasing of the two sealing jaw halves 190 and 200 against each other during the sealing moment, this procedure/function will be explained in more detail later in this description. The cam curve disc 210 and its associated parts and couplings are shown in figs. 1, 5, 6, and 7. The whole actuation device 220 is shown in fig. 1 and parts of it are shown in figs. 2-7.

Figs. 2-4 illustrates only the first right half 150, 170, and 190, respectively, of the two package engaging halves for each of the three link systems 120, 130, and 140 separately for clarity reasons, so that the structure of each link system may be easily and clearly explained and recognised. The first left package engaging half 160, 180, and 200, respectively, for each of the link systems 120, 130, and 140, corresponds to its first right and opposite package engaging half, the only difference between the two opposite package engaging halves are that the left package engaging half is mirror-inverted in relation to its opposite right package engaging half.

In figs. 2-4, the second sealing device pair 90 behind the frame 80 is excluded for clarity reasons. This means that the other head space device 120, the forming tool 130, and the sealing jaw 140 behind the frame 80 as seen in fig. 1 also are excluded for clarity reasons, as explained earlier.

In fig. 2, only the first right head space half 150 (shown to the right in fig. 1) of the first link system

120, i.e. the head space device 120 is shown in a cutout view for clarity reasons. Here, the head space device with its first right head space half 150 and its first left opposite head space half 160 (not shown) is in its package engaging position for adjusting the volume of the substance in the head space of each package 20 right before the package is sealed.

In fig. 3, only the first right forming tool half 170 (shown to the right in fig. 1) of the second link system 130, i.e. the forming tool 130 is shown in a cutout view for clarity reasons. Here, the forming tool with its first right forming tool half 170 and its first left opposite forming tool half 180 (not shown) is in its package engaging position for gripping and holding each package 20 during sealing of the package.

In fig. 4, only the first right sealing jaw half 190 (shown to the right in fig. 1) of the third link system 140, i.e. the sealing jaw 140 is shown in a cutout view for clarity reasons. Here, the sealing jaw with the first right sealing jaw half 190 and the first left opposite sealing jaw half 200 (not shown) is in its package sealing position for performing a folding before a subsequent sealing of the package 20.

The right first head space half 150 of the head space device 120 in fig. 2 comprises a package engaging member 121, which is attached at a first end 122a of a first essentially vertical bar 122. The second end 122b of the bar 122 is rotatably connected to a first horizontal shaft 123 of metal protruding through a hole in the frame 80. The first horizontal shaft 123 may be securely attached to the frame 80 by pressing, moulding, or welding. The bearing between the first vertical bar 122 and the first horizontal shaft 123 is a slide bearing of plastic in contact with the metal shaft. A essentially second vertical flat bar 124 working as an arm is connected with a first end 124a to a free first end 123a of the first horizontal shaft 123. The first horizontal

shaft 123 protrudes out on the other side of the frame 80, so that the other head space half 150 (excluded) can be rotatably fastened in the same way as the nearest head space half.

In fig. 2, the essentially vertical flat bar 124 is made of metal, preferably, alloy steel that fulfills the hygienic requirements of the present invention, e.g. a sufficient durability against cleaning detergents, acids and bases, and connected with a second end 124b to a first end 125a of a essentially horizontal second flat bar 125 by means of a pin. This horizontal second flat bar 125 is connected with a second end 125b to a joint 126 in the form of a essentially triangular coupling 126. This triangular coupling 126 is rotatably connected to the frame 80 by means of a essentially horizontal second shaft 127 protruding through and out of the frame, achieving the same function, attachment, and bearing for another triangular coupling (not shown) and associated means for the other excluded head space half behind the frame 80.

The triangular coupling 126 in fig. 2 has a essentially symmetrical shape and is connected to the horizontal second flat bar 125 at a first corner of its three corners. The triangular coupling is connected to the essentially horizontal second shaft 127 at a second corner, and connected to a first end 128a of a essentially vertical first tie rod 128 at its third corner. The triangular coupling 126 is locked and supported at the side adjacent the frame 80 in the lateral direction, i.e. the axial direction of the horizontal shaft 127 by a first fork or finger-like plate 151 with a open recess partly surrounding or engaging the shaft 127. The first finger-like plate 151 is rotatably attached to a first end of a third horizontal shaft 129 protruding through the frame 80 out on the other side so that another finger-like plate for the second right head space half (not shown) behind the frame 80 may be

attached to the other end of the shaft 129. A second end 128b of the tie rod 128 of the head space is operatively connected to the cam curve disc 210 by means of movable actuation means (not shown), which will be explained in more detail later in this description. The mirror-inverted other head space half 160 (not shown) opposite this head space half 150 is also constructed/designed in the same way with corresponding associated mirror-inverted head space parts, and will not be explained in this description.

A sealing 240 in the form of flexible hose is shown in figs. 1-4. This flexible hose 240 surrounds the tie rod 128, this first tie rod 128 will be designated as the head space tie rod throughout the following description for clarity reasons, in fig. 2 and comprises at least one bushing and one sealing for guiding the head space tie rod 128 when the tie rod moves and fittings for a sealed connection to the middle frame section 70 of the frame 80. The flexible hose is adapted to seal off the tie rod and the drive equipment 60 from the sealing equipment 40, and the flexible feature of the hose is required due to the fact that the tie rod not only moves axially but also laterally beacause of the shape of the triangular coupling 126, therefore the sealing between the sealing equipment and the drive equipment must ensure a sufficient sealing by being able to follow the movement of the tie rod a little.

In fig. 2, a locking device 230 in the form of a plate 230 is shown. This plate 230 has an irregular shape and is placed at each half of the four linkage arrangements 100, 110, i.e. there is a total of four plates 230 in the sealing apparatus 10. The plate 230 is adapted to support, hold and lock all the moving parts in each linkage arrangement 100 and 110 in the lateral direction, more specifically, in the axial direction of the first horizontal shaft 123 and the second horizontal shaft 127 of the first right head space half 150, this is

clearly seen in figs. 1-4. This plate eliminates the need for locking devices at each end of the shafts 123, 127 and each pin holding the moving parts together, thereby reducing the number of parts and enhancing the maintenance and disassembly of the sealing apparatus 10 because the bars 122, 124, 125 and the triangular coupling 126 are easily slid on and off their associated pins and shafts after removing the plate 230. The locking device 230 is attached by being tightened with screws at three points, a first screw at a top point, i.e. at a threaded end or hole of a horizontal shaft for support of a triangular coupling (similar to the triangular coupling 126) for the first right sealing jaw half 190 (shown in figs. 1 and 4), a second screw at a middle point, i.e. at a threaded end or hole of a horizontal shaft for support of a triangular coupling (similar to the triangular coupling 126) for the first right forming tool half 170 (shown in figs. 1 and 3), and a third screw at a lower point, i.e. at a threaded end or hole of the horizontal shaft 127 for support of the triangular coupling 126 for the first right head space half 150 (shown in figs. 1 and 2).

The plate 230 shown in figs. 1-4 could of course, as is readily understood by a skilled person, be attached at any other suitable position or with any other suitable number or type of attachment means instead of only three, e.g. less than three or more than three if desired, as compared to this embodiment. The plate could also be clamped at suitable positions against the associated attachment points, as is readily understood by a skilled person.

There is a total number of sixteen similar flexible hose sealings 240 in the sealing apparatus 10 in this embodiment of the invention. Four sealings 240 for the four head space devices 120, four sealings 240 for the four forming tools 130, and eight sealings 240 for the four sealing jaws 140. This number of sealings may of

course be modified, i.e. increased, if more pairs of sealing devices 90 were to be utilized in the sealing apparatus or if a larger double sealing could be used for at least two tie rods instead of only one, the number of sealings could be reduced in this embodiment.

In fig. 3, the first right forming tool half 170 also is shown separately. Here, the same locking plate 230, and a similar sealing 240 as in fig. 2 for the head space half 150 are illustrated and will not be explained in more detail. The right first forming tool half 170 of the forming tool 130 (shown in figs. 1 and 3) comprises a package engaging member 131, which is attached at a first end 132a of a essentially vertical bar 132 consisting of two parallel flat bars extending vertically upwards. The second end 132b of the double bar 132 is rotatably connected to a first end 133a of a fourth horizontal shaft 133 of metal protruding through a hole in the frame 80.

This fourth horizontal shaft 133 shown in fig. 3 may be securely attached to the frame 80 by pressing, moulding, or welding and is placed above the first horizontal shaft 123 of the head space half 150 in the vertical direction. The bearing between the bar 132 and the horizontal metal shaft 133 is a slide bearing of plastic in contact with the metal shaft. A movable essentially horizontal single flat bar 134 working as an arm is connected with a first end 134a to the vertical double bar 132. The first end 134a is attached with a pin against the vertical double bar a distance from the package engaging member 131, or from the first end 132a of the vertical bar 132, which is about 1/5 of the total length for the vertical bar 132.

The suitable connection point for the end 134a of the arm 134 and its distance from the end 132a shown in fig. 3 depends on forces required for moving the package engaging member 131 and its desired path of movement, this is readily understood by skilled person. The fourth

horizontal shaft 133 in fig. 3 protrudes out on the other side of the frame 80, so that the other forming tool half 170 (excluded) can be rotatably fastened in the same way as the nearest forming tool half described above.

In fig. 3, the essentially vertical flat double bar 132 is made of metal and the essentially horizontal single flat bar 134 is made of rigid and bearing grade plastic and rotatably connected with a second end 134b to a first corner 135a of a triangular coupling 135 similar in shape but larger than the triangular coupling 126 for the head space devices 120 by means of a pin. This triangular coupling 135 is rotatably connected at a second corner 135b to the frame 80 by means of a essentially horizontal second shaft 136 protruding through and out of the frame, achieving the same function, attachment, and bearing for another triangular coupling (not shown) and associated means for the other excluded forming tool half behind the frame 80.

The triangular coupling 135 in fig. 3 is connected to the essentially horizontal second shaft 136 at the second corner 135b, and connected to a first end 139a of a essentially vertical second tie rod 139 at its third corner 135c. The triangular coupling 135 is locked and supported at the side adjacent the frame 80 in the lateral direction, i.e. the axial direction of the horizontal shaft 136 by a fork or finger-like plate 137 similar and attached or engaging the shaft 136 in the same way as the first fork plate 151 and the shaft 129 in fig. 2 and will therefore not be explained further. A second end 139b of the second tie rod 139, which will be designated as the forming tool tie rod 139 from now on, is operatively connected to the cam curve disc 210 by means of movable actuation means (not shown), which will be explained in more detail later in this description.

In fig. 4, the first right sealing jaw half 190 is shown separately without its opposite first left sealing jaw half 200. Here, the same locking plate 230, and a

similar sealing 240 as in figs. 2 and 3 for the head space half 150 and the forming tool half 170 are illustrated and will not be explained in more detail. The right first sealing jaw half 190 of the sealing jaw 140 (shown in figs. 1 and 4) also comprises a package engaging member 141 for sealing the package 20 (not shown), the package engaging member 141 is attached at a first end 142a of a third horizontal bar 142 consisting of two parallel flat bars extending horizontally to the right in figs. 1 and 2.

In this fig. 2, the third horizontal bar 142 is shown in a essentially horizontal sealing position but may be angled depending on the operation of the sealing apparatus 10 in fig. 1. The third horizontal bar 142 performs a movement from a first retracted position into the essentially horizontal sealing position shown in figs. 1 and 2 during operation of the seling apparatus 10, this operation will be explained later on in this description. The structure of the sealing jaw half 190 shown in figs. 1 and 2 will be described based on the "static" or "frozen" sealing position illustrated in fig. 2.

The first end 142a of the third horizontal bar 142 shown in figs. 1 and 2 is rotatably attached adjacent the package engaging member 141 by means of pins, one for each bar. The second end 142b of the third horizontal bar 142 is rotatably connected to a first end 143a of a fourth horizontal bar 143 also consisting of two parallel flat bars extending horizontally to the right in figs. 1 and 2 and very similar to the third horizontal bar 142. The second end 143b of this fourth horizontal bar 143 is rotatably connected to a first corner 144a of a third triangular coupling 144 similar to the triangular couplings 126 and 135 in figs. 2 and 3. This structure with a fourth horizontal bar 143 fitting in between the two flat bars of the third horizontal bar 142 is very similar to a chain with only two links, one chain link

being the third horizontal bar 142 and the second chain link being the fourth horizontal bar 143.

In fig. 4, a essentially vertical bar 145 is connected at one end 145a to the first end 142a of the third horizontal bar 142 and the package engaging member 141 for sealing the package 20 (not shown). The other end of the vertical bar 145 is somewhat curved, similar to the essentially vertical bar 132 in fig. 3, and rotatably connected to a first end 146a of a essentially horizontal shaft 146 penetrating through a hole in the frame 80 in the same way as the horizontal shafts 123, 127, 129, 136, and 138 in figs. 2 and 3 and will therefore not be explained in any more detail.

This essentially vertical bar 145 in figs. 1 and 2 has a shape essentially corresponding to the shape of a human leg pointing upwards with the foot at the top and the toes pointing to the left in fig. 4, i.e. towards the package engaging member 141, whereby the toes actually constitute the package engaging member 141. In this embodiment, the bar 145 is made of two flat bars held together by two pins 147 placed inside the top end 145a and extending axially in the same direction as the transported packages 20 (not shown). Each of the pins 147 has two ends of which one end is attached adjacent the toe side of the vertical leg-like bar 145 and the other end is attached adjacent the heel side of the vertical leg-like bar 145 made of metal.

The first end 142a of the third horizontal bar 142 in figs. 1 and 4 is held in place in the lateral direction, i.e. the package transport direction, and supported only by the locking plate 230 and is therefore easy to disconnect from the vertical bar 145 during maintenance by only removing the locking plate 230. This means that also the fourth horizontal bar 143 and the vertical bar 145 are indirectly held in place in the same way by the locking plate due to the supported third horizontal bar 142. The two horizontal bars 142 and 143

are made of rigid and bearing grade plastic and slides against the vertical metal bar 145, the locking plate 230, and a distance plate 250 (shown in fig. 1-3 but only partly shown in fig. 4), there are two distance plates 250 being used in the sealing apparatus 10, one for the right linkage arrangement 100 and one for the left linkage arrangement 110. These two distance plates 250 made of metal keep the two sealing devices 90 apart and function as supports for the inside of each linkage arrangement 100 and 110 for holding them in the lateral direction, i.e. in the same direction as the package transport direction.

In fig. 4, the second end 143b of the fourth horizontal bar 143 is rotatably connected to the first corner 144a of the third triangular coupling 144 by means of pins. A second connecting pin 148 is attached at the first end 143a of the fourth horizontal bar 143. The second connecting pin 148 extends axially in the same direction as the package transport direction and is placed between the two flat bars adjacent the third horizontal bar 142. The second connecting pin 148 has two ends, one end connected to one of the flats bars forming the fourth horizontal bar 143 and the other end connected to the opposite one of the flats bars forming the fourth horizontal bar. A first sealing jaw tie rod 191 is connected with one end 191a to the second connecting pin 148 and extends essentially vertically downwards from a middle section of the second connecting pin. The first sealing jaw tie rod 191 extends downwards and is connected with a second end 191a to a first end 192a of a second sealing jaw tie rod 192. This second sealing jaw tie rod penetrates a third sealing hose 240 and through the middle frame section 70 in the same way as the tie rods in figs. 2 and 3. The second end 192b is connected to the drive equipment 60 and associated actuation means in the same way as the tie rods in figs. 2 and 3.

A second corner 144b of the third triangular coupling 144 in fig. 4 is rotatably connected to a first end 193a of a third sealing jaw tie rod 193 extending essentially vertically downwards in fig. 4. This third sealing jaw tie rod 193 penetrates a fourth sealing hose 240 and through the middle frame section 70 in the same way as the tie rods in figs. 2 and 3. The second end 193b of the third sealing jaw tie rod 193 is connected to the actuation device 220 mentioned earlier, and will be explained in more detail later in this description.

Figs. 2-4 show the first right head space half 150, the first right forming tool half 170, and the first right sealing jaw half 190 in their volume adjusting, holding , and sealing position, respectively, which are the end position for each half. The relative movements for the head space device 120, forming tool 130, and the sealing jaw 140 and their functions will be explained later on in this description.

Fig. 5 illustrates only the second lower section 50 and parts of the drive equipment 60, i.e. the first upper section 30, a upper part 80a of the frame 80, and the cam curve disc 210 are excluded for clarity reasons. Here, the lower section 50 is shown in an opposite view, i.e. from the other side, compared to fig 1.

The lower part 80b of the frame 80 is connected to the upper part 80a (not shown) of the frame by connecting means 81 (shown in fig. 1). The lower part 80b comprises two cylinder shaped beams onto which two support means 82 (also shown in fig. 1) are fitted and at least one square beam supporting the lower section. The support means 82 are normally locked by means of clamping against the lower part 80b during operation of the sealing apparatus 10 but are released when the second lower section, especially, the drive equipment 60 is to be maintained. After releasing the locking means, the support means 82 can be slid, whereby the whole lower section 50 can be moved by pulling in handles 83 in the form of a fixed

frame to the left in fig. 5 and to the right in fig. 1. This simplifies the maintenance of the drive equipment 60 and replacement of parts in the lower section 50, especially, the drive equipment and its associated parts/components.

In fig. 5, an electric motor 61 is placed to the right for driving a transmission/gear box 62 which in turn drives the cam curve disc 210 (not shown). The handles 83 and the support means 82 are connected to the transmission box or gear box 62 by means of a support bracket 63. The drive equipment 60 and its associated components are controlled by a control unit (not shown) using on the market common and easily available detector means (not shown) for fulfilling the requirements of a reliable operation of the sealing apparatus 10 and will not be explained any further because this is common knowledge for a skilled person.

The lower part of the frame 80b also has a vertically extending middle part having a linear path in which at least three carriers or travelling gears move, a first bottom carrier 64, which is connected to the second end 128b of each of the four head space tie rods 128 (shown in figs. 1 and 2) for moving all of the head space devices 120 (partly shown), a second middle carrier 65, which is connected to the second end 139b of each of the four forming tool tie rods 139 (shown in figs. 1 and 3) (partly shown) for moving all of the forming tools 130, and a third top carrier 66 (partly shown), which is connected to the second end 192b of each of the four sealing jaw tie rods 192 (shown in figs. 1 and 4) for moving all of the sealing jaws 140. These carriers 64, 65, and 66 and their associated components are shown in more detail in fig. 7.

In fig. 5, the actuation device 220 and its associated parts are only partly shown but is more clearly shown in fig. 6. Here, in fig. 6, the electric motor 61, the tranmission box 62, the support bracket 63,

the support means 82, and the handles 83 are excluded for clarity reasons. The carriers 64, 65, 66 are partly shown to the right in fig. 6.

The actuation device 220 shown clearly in fig. 6 comprises two air driven cylinders, a first lower cylinder 221 and a second upper cylinder 222, both cylinders being securely attached to the lower part 80b of the frame 80. The first cylinder 221 has a first end 221a with a shape essentially corresponding to a first lower wheel in a tackle block or a fishing roll. The first cylinder 221 is rotatably attached to the centre of the first lower wheel in the axial direction, whereby the first lower wheel is in rotatable communication with two arms, a first arm 223 and a second arm 224 in the form of square beams and actuates them when the first lower wheel is pulled downwards by the first cylinder 221 during sealing of packages 20. This pulling is done for giving a additional pressing force from the sealing jaw 140 so that the sealing of a transversal joint at the bottom of each package 20 is ensured in a sufficient way, the second upper cylinder 222 has the same function, this function will be explained in more detail later on in this description.

The first end 221a of the first cylinder 221, shown in fig. 6, i.e. the first lower wheel, has a concave surface forming a roll path, which engages a convex surface on each first end 223a and 224a of the first and second beams 223 and 224, respectively. In this embodiment, the convex surface on each first end 223a and 224a is a rotatably supported cylinder extending in the perpendicular direction in relation to the centre axis of the first cylinder 221. These concave and convex shapes of the engaging surfaces between the first cylinder and each of the beams 223, 224 being attached at their second ends 223b and 224b to a first and a second through shaft 225 and 226, respectively, which in turn is rotatably supported/attached to bearings in the lower part 80b of

the frame 80 and protrudes through the bearings out on the other side of the lower frame part 80b, this is clearly seen to the right in fig. 6, in combination with the pulling of the first cylinder 221 means that there is lesser risk of jams due to fixed surfaces, which can not move in relation to each other, because the first cylinder shaped ends 223a and 224a can rotate against the concave inner contacting surface of the first lower wheel. The shape of the first lower wheel at the first end 221a of the first cylinder 221 also means that the piston rod (not shown) of the first cylinder can rotate rather freely during operation of the first cylinder and the wear of the engaging surfaces between the first lower wheel and each cylinder of each first end of each beam 223 and 224 is more evenly distributed around the periphery of the first lower wheel.

Each of the rotatably supported first and second through shafts 225 and 226 in figs. 1 and 6 extends from a first end 225a, 226a adjacent the second end 223b, 224b for each beam 223, 224 through the bearings in the lower frame part 80b out on the other side to a second end 225b, 226b being fixedly connected to a first and second support beam 227 and 228, respectively, in the form of a thick bar plate being connected to connection means 229 in the form of an ear with a through hole for receiving a pin or screw for holding and actuating one of the two sealing jaw tie rods (not shown) beyond the upper frame part 80a in fig. 1, i.e two of the four third sealing jaw tie rods 193 shown in figs. 1. The other two of the third sealing jaw tie rods 193 are connected and actuated by the second upper air driven cylinder 222 and its associated parts, which will be described in the following.

The second upper cylinder 222 shown in fig. 6 has essentially the same structure and comprises at its first end 222a a second wheel similar to the first wheel of the first cylinder 221 and will not be explained in more

detail regarding these components. One difference between the first cylinder 221 and the second cylinder 222 is that the second cylinder is placed upside down in relation to the first cylinder. Another difference is the shape and structure of two beams or arms, a third beam/arm 260 and a fourth beam/arm 261, both arms having the same function as the first and second arms 223 and 224 for creating an additional pressing force in the two pairs of sealing jaws 120 during the sealing of packages 20. Each of these arms 260 and 261 has two ends, a first end 260a and 261a, respectively, connected to the second wheel by means of a similar cylinder as for the first and second actuating arms 223 and 224, and a second free end 260b and 261b, respectively, each free end being connected to connection means 229 similar to the ones used by the first cylinder.

In fig. 6, each of the third and fourth actuating arms 260 and 261 is fixed to a supporting pin, the third actuating arm 260 is attached to a first supporting pin 262, and the fourth actuating arm 261 is attached to a second supporting pin 263, each supporting pin being fixedly attached at a position adjacent the free second end of the associated arm. This means that the length of the lever from the centre axis of the supporting pin towards the first end of each arm, i.e. the end adjacent the second cylinder, is longer than the length of the lever from the centre axis of the supporting pin towards the second end of each arm, i.e. the free end adjacent the connection means 229. The supporting pin is rotatably supported by bearings in the lower frame part 80b, whereby each arm 260 and 261 rotates around the centre axis of its associated supporting pin when the second cylinder 222 pulls the first end of each arm 260 and 261 upwards, whereby the second end for each arm at the same time is pulled downwards.

In fig. 7, the carriers 64, 65, 66 and their associated parts are shown in more detail with the

electric motor 61, the transmission box 62 and the cam curve disc omitted for clarity reasons. The carriers control the operation of the four sealing devices 90 (not shown) used in the sealing apparatus 10. Here, each carrier comprises guiding means 67 for guiding each carrier along the linear path on the lower frame part 80b during the movement of each carrier, at least one cam or tappet 68 being rotatably attached to a support or release device 69, which cam is fitted into the associated cam curve (not shown) on the cam curve disc 210 (not shown) and follows the cam curve, thereby moving its associated carrier along the linear path upwards and downwards. The carriers are moved relatively each other by rotating the cam curve disc (not shown) using the electric motor 61 and the transmission box 62. The use and function of a cam curve disc and carriers moving by means of such a cam curve disc is common knowledge for a skilled person and will only be explained in basic terms.

Fig. 7 shows the carriers 64, 65, 66 in one position in relation to each other. The lower carrier 64 controls the movement and operation of the two head space devices 120 by means of the four head space tie rods 128 (shown in figs. 1 and 2), each tie rod being attached with its second end 128b to attachment means 84 on the associated carrier 64. Each carrier has four attachment means 84 corresponding to four tie rods 128, 139, 191, and 192 (shown in figs. 1-4) for each carrier 64, 65, 66. The positions for the attachment means 84 on each carrier, in this embodiment, are symmetrically distributed with two attachment positions to the right in fig. 7 and the other two attachment positions to the left in fig. 7. The third sealing jaw tie rod 193 (shown in fig. 4) is connected to the actuation device 220 creating an additional pressure force on the package 20 (not shown) during sealing, as explained earlier.

In fig. 7, the support device 69 on each carrier 64, 65, 66 has a function of releasing the associated carrier

if the carrier, i.e. its cam 68, is jammed in its cam curve creating large forces due to the inertia in the cam curve disc 210, which may destroy or at the least damage the sealing apparatus 10 severly. In this embodiment of the present invention, the support device comprises a disc 69a, a locking pin 69b, a locking device 69c, a spring 69d, an arm 69e on which the locking pin is attached, the arm in turn being rotatably attached to the locking device biasing the rotary arm with its locking pin against the disc 69a. The disc has a recess in which the biased locking pin fits, whereby a large force on the cam due to any reason would turn the disc 69a so that the locking pin is forced out of the recess, releasing the disc 69a and thereby eliminating/reducing any damages to the sealing apparatus.

The movement of the carriers 64, 65, 66 will now only be concisely explained with reference to fig. 7 and the operation and movements of the sealing devices 90 (not shown) will be explained in more detail with reference to figs. 1-4. If any of the carriers is moved upwards in fig. 7, each associated package engaging part of the head space device 120 (shown in fig. 2), the forming tool 130 (shown in fig. 3), or the sealing jaw 140 (shown in fig. 4) is moved from the package, and if any of the carriers is moved downwards in fig. 7, each associated package engaging part of the head space device, the forming tool, or the sealing jaw is moved into contact/engagement with the package to be sealed.

In figs. 8-10, a T-shaped (wing like) device 270 is shown, this device is very similar to a flap for facilitating the forming and folding of each package 20 and will be denoted as a forming flap from now on in this description. Here, only one wing like device or forming flap 270 is illustrated and rotatably attached with a first end 270a, the vertical member, i.e. the vertical leg of the T, to each of the two forming tool halves 170 and 180. One forming flap 270 is attached against one

end, i.e. an upper side 170a of the first right forming tool half 170 and one forming flap 270 is attached against an upper side 180a of the first left forming tool half 180 (not shown), this first left forming tool half 180 is only partly shown in fig. 1. The function of this pair of forming flaps 270 will only be explained with reference to one device because the other device in each pair of the second linkage arrangement 130, i.e. the forming tool, works and moves in a similar mirror-inverted way.

The forming flaps 270, in the vertical direction, as seen in fig. 1, are placed between the third pair of linkage arrangements, i.e. the sealing jaw 140 and the second pair of linkage arrangements, i.e. the forming tool 130. The reason for this is to ensure that the movable halves 150, 160, 170, 180, 190, 200 of the linkage arrangements, i.e. the head space device 120, the forming tool 130, and the sealing jaw 140 are freely movable in relation to each other during sealing and closing of each package 20. The distance in the vertical direction between the three pairs of linkage arrangements, i.e. the head space device 120, the forming tool 130, and the sealing jaw 140, is adjustable by having their package engaging members 121, 131, and 141 releasably attached on their vertical members 122, 132, 145. The adjustment means may be screws locking the package engaging members against the vertical members or means for clamping the package engaging members members against the vertical members, this is readily understood by a skilled person.

The forming flap 270 shown in figs. 8-10 is slightly biased, in the non-operating or non-sealing state, i.e. when the sealing jaws 190, 200 is in a first open position, in an essentially vertical direction upwards, by means of a wing pin 280 protruding through attachment holes 171 and 181 in each upper side 170a, 180a of the forming tool halves 170 and 180, and being provided with

resilient biasing means in the form of at least one spring 281, e.g. a helical spring or a plate spring. The forming flap 270 is adapted to be rotated, or, more specifically, pivoted from a first essentially vertical position (not shown) into a second angled position with the second end 270b in contact with a portion of each package 20 (shown in figs. 8-10), i.e. when the sealing jaws 190, 200 is in a second closed position for sealingly closing each package. The sealing apparatus 10 seals at least two packages 20 at a time when operating in this embodiment but could of course be sealing more or less than two depending on the production requirements and the available space for the sealing apparatus, whereby only one pair of sealing devices 90 would reduce the size of the apparatus and the production/sealing rate, and more than two pairs of sealing devices 90 would increase the size of the apparatus and the production/sealing rate, as is readily understood by a skilled person.

The essentially T-shaped (wing like) device or flap 270 shown in figs. 8-10 is rotatably attached with its vertical leg of the T, i.e. its first end 270a, to the upper side 170a, 180a of each forming tool half 170, 180 of the second pair of linkage arrangements 130, i.e. one of the forming tools. The second end 270b of the T-shaped flap 270 is the overhead horizontal leg of the T, and the first end 270a of the T-shaped (wing like) flap 270 is the vertical leg of the T.

The three pairs of linkage arrangements 120, 130, 140 shown in fig. 1 for sealing each package 20 are placed on a vertical distance from each other, which distance is adjustable so that the moving parts, i.e. the movable halves 150, 160, 170, 180, 190, 200 in the pairs do not collide when moved during operation of the sealing apparatus 10, i.e. during the closing and sealing of the open end 20a for each package 20. The horizontal bars 123, 133, 146 shown in figs. 1-4 for rotatable attachment

of the second ends 122b, 132b, 145b of these horizontal bars and the first end 124a of the vertical bar 124 in fig. 2 to the upper frame part 80a of the frame 80 are made of solid metal and have a cylinder shape. These horizontal bars 123, 133, 146 are placed on a vertical distance from each other and aligned in the direction of their centre axes. The alignment is not necessary, i.e. any other suitable attachement point is equally conceivable as long as it is placed sufficiently far from each package 20, i.e. its open 20a, due to the hygienic requirements. The other second end 20b, i.e. in fact the top end (not shown) of the package, because the packages are handled upside down during the sealing procedure in the sealing apparatus 10, more specifically, all the time when present in the sealing apparatus, and the subsequent folding procedure (not shown) can have any suitable form.

The third pair of linkage arrangements 140, i.e. the sealing jaw, with the two halves 190, 200 for sealing each package 20 is placed on a vertical distance from the upper side 170a, 180a of each half 170, 180 of the second pair of linkage arrangements 130, i.e. the forming tool, which vertical distance is adapted so that the T-shaped flap 270 is moved by the two halves 190, 200 contacting/engaging the T-shaped flap from its first essentially vertical position into its second angled position by being rotated towards and into contact with the package 20 to be sealed. This means that the wing like flap 270 on either of the two forming tool halves 170 or 180 is pushed from its first essentially vertical position (not shown) from the left in fig. 10 to the right in fig. 10 towards the package 20, the same goes for the opposite placed wing like on the opposite forming tool half 170 or 180. The rotation of the flap into contact with the open end 20a of the package 20 means that the flap presses at two opposing sides of the package towards each other because the forming tool grips/holds the package adjacent its open end. The flap

270 is placed between the sealing jaws 140 and the forming tools 130. The head space devices 120 presses each package 20 at a distance from the open end 20a on opposing sides of the package.

Now, the operation and movements of the sealing devices 90 will be explained in more detail with reference to figs. 1-4. In fig. 1, all of the sealing devices 90, i.e. the operation and movements of the two pairs of head space devices 120, the two pairs of forming tools 130, and the two pairs of sealing jaws 140 and their associated two halves 150, 160, 170, 180 will be explained with reference to only one pair of head space devices 120, forming tools 130, and sealing jaws 140, and, more specifically, only one half of these, i.e the first right head space half 150, the first right forming tool half 170, and the first right sealing jaw half 190 for clarity reasons. The reason for this is that the opposite first left half for each of the above-mentioned first right halves moves in the same way but with mirror-inverted movements.

There is a functional and structural difference between the two sealing jaw halves 190 and 200, the difference being that only the first right half 190 actively performs the sealing of each package 20 (partly shown in figs. 8-10), while, at the same time, the other opposite first left half 200 only works as an anvil during the sealing procedure. This means that the right half 190 is provided with the active sealing means and the opposite left half 200 basically has a shape corrsponding to the other right half for ensuring a secure sealing. The sealing could be so-called induction sealing where a radio frequency alternating current is supplied and causes induced currents in a aluminium foil provided in each multi-layer package 20, thereby heating the aluminium foil, which in turn heats a plastic layer in the multi-layer package. The sealing may also be a so-called ultrasonic sealing, where a ultrasonic oscillation

is applied to the packaging material in the package to be sealed such that the hysteresis heats the interface between the materials to be sealed together. Moreover, the sealing could also be a so-called impulse heating where a hot baris put in abutment/contact with the packaging material such that a plastic material in the interface temporarily at least partly melts and then solidifies creating the sealing. These above-mentioned ways of sealing packages are well-known and will not be explained in more detail.

Now, the function of the sealing apparatus 10 and a method of operating it according to the invention will be described with reference to figs. 1-4, and 8-10 and two different embodiments, a first embodiment in which the sealing apparatus 10 operates without the forming flaps 270 and a second embodiment in which the sealing apparatus uses the forming flaps. The operation and sealing procedure steps are essentially the same for both embodiments, the only difference concerns the folding of the package 20 when the sealing jaw 140 engages the package just before it is going to be sealed transversally.

The sealing apparatus 10 shown in fig. 1 has a first primary position, i.e. a starting position or an open position (not shown), which is a standby state for the sealing apparatus just before a package 20 enters the sealing apparatus, and a second primary position, i.e. a final position for sealing and closing the package. This open position is defined in the following way: the sealing jaw 140 is open, i.e. the two sealing jaw halves 190, 200 are positioned in their position farthest from each other. This also means that the head space device 120 and the forming tool 130 and their halves 150, 160, 170, 180, respectively, are in corresponding positions in relation to each other, and that the carriers 64, 65, 66 also are in their highest positions, and each tie rod 128, 139, 191, 192, and 193 is extended.

In this first open primary position (not shown), the tie rods 191 and 192 in fig. 4 have pushed the second sealing jaw connecting pin 148 upwards in fig. 4, at the same time, pushing the second end of the third horizontal bar 142 and the first end of the fourth horizontal bar 143 upwards. These two horizontal bars 142 and 143, work as chain links, with a toggle or elbow connecting joint, whereby the pushing of these upwards bends the elbow joint upwards, so that the the second sealing jaw connecting pin 148 is disposed vertically above the frame 80.

In this open first primary non-sealing position, the two actuating cylinders 221 and 222 shown in figs. 1 and 4 for pulling associated third sealing jaw tie rods 193 are retracted.

In this open first primary position for the sealing apparatus 10, a package 20 is supplied into the sealing apparatus. The forming tool 130 with its two halves 170, 180 firstly grips or grasps the package from opposite , i.e. opposing sides or portions by pulling or retracting the forming tool tie rod 139 in fig. 3 by means of the forming tool carrier 65 in fig. 7 being controlled or operated by the support device 69 following the associated cam curve for the forming tool carrier in the cam curve disc 210 in fig. 1. At the same time, the head space device 120 with its two halves 150, 160 moves towards the package 20 from opposite sides or portions, and, instanteously makes a stop when touching the package, and, then, starts pressing against the package for adjusting the volume contained in the package. The movement or pivoting of the head space device is done in the similar way as for the forming tool by pulling or retracting the head space tie rod 128 in fig. 2 by means of the head space carrier 64 being controlled/operated by the support device 69 in fig. 7 following the associated cam curve for the head space carrier in the cam curve disc 210 in fig. 1.

After this, the sealing jaw 140 with its two opposite placed sealing halves or jaws 190, 200 is actuated, the halves 150, 160, 170, and 180 are also placed opposite each other. The movement or pivoting of the sealing jaw 140 is done in the essentially similar way as for the head space device 120 and the forming tool 130, the main difference is that three tie rods are pulled or actuated by two different means, i.e. the sealing jaw carrier 66 with associated means and the actuation device 220 shown in fig. 1. The first tie rod 191 and the second tie rod 192 in fig. 2 connected to the sealing jaw carrier 66 are pulled by moving the sealing jaw carrier being controlled or operated by the support device 69 in fig. 7 following the associated cam curve for the sealing jaw carrier in the cam curve disc 210 in fig. 1 in a similar way as described for the head space device 120 and the forming tool 130.

In the first embodiment of the present invention without the forming flaps 270, the following steps of folding and sealing the initially open end 20a of the package 20, the end 20a is never shown in its open state, it is only shown in its folded state in figs. 8-10. This pivoting/movement of the sealing jaw 140 is performed until the sealing jaw comes into contact with opposing outer sides/portions of the open end 20a of the package 20 to be sealed and press the opposing sides or portions of the package almost into a sealing contact and is stopped a certain small distance before the two opposing inner portions/surfaces of the opposing sides/portions of the package come into contact. In this position, the head space device 120 is actuated and moves slightly towards the package, whereby the contained volume, i.e. the amount of air in the package 20 is finally adjusted.

After this final volume adjustment of the head space device 120 shown in fig. 2, the sealing jaw 140, i.e. its both opposite placed halves 190 and 200 are moved towards each other by actuating the associated actuating cylinder

221 and 222, respectively, which then pulls its associated third sealing tie rod 193, thereby pressing each sealing jaw half 190, 200 further towards each other with greater force. Then, the sealing is performed by actuating the sealing jaw by using any known sealing method, e.g. induction sealing, ultrasonic sealing, or the so-called impulse heating. This additional pressing of the sealing jaw halves 190 and 200 a small distance by means of the actuation device 220 with its associated parts and actuating cylinders 221 and 222 facilitates the sealing of the transversal joint, whereby there is a lesser risk of leakage from each package 20 during further handling.

The movement of the head space device 120 with its two halves 150, 160 are done in a way that the pressing of the package 20 has begun before the sealing halves or jaws 190, 200 comes in contact with the package. The movement of the head space device 120 with its two halves 150, 160 are done in a way that the pressing of the package are finished before the movement of the sealing halves or jaws 190, 200 is stopped.

In the second embodiment of the present invention with the forming flaps 270, the following steps of folding and sealing the initially open end 20a of the package 20, the end 20a is never shown in its open state, it is only shown in its folded state in figs. 8-10. Here, the two sealing jaw halves 190 and 200 are pivoted/moved towards each other and comes into contact with a portion of the vertically pointing second end 270b shown in figs. 8-10 of the forming flaps 270. This is readily understood in view of fig. 10, where the forming flap has been pivoted from its first essentially vertical position (not shown) to its second angled position from left to right in fig. 10 by the associated sealing jaw half (shown in figs. 1 and 4).

When the associated sealing jaw half 190 or 200 pushes the associated forming flap 270 towards the

package 20, the forming flap partly follows the sealing jaw until the sealing jaw half passes over the forming flap. The second ends 270b of the forming flaps and the package engaging members 141 of the associated sealing jaw come into contact with opposing portions or sides of the package and supports/facilitates the folding and forming of the open end 20a of the package during forming and sealing into a closed end.

After this, the sealing is performed and, when the sealing is completed, the sealing jaw 140, the forming tool 130, and the head space device 120 are reversed and moved/rotated away from the package 20, in the same way as for the first embodiment. Then, or, more specifically, by partly following the reversed movement of the sealing jaw 140 in this second embodiment, the forming flaps 270 are biased/moved by the spring 281 shown in figs. 8-10 back to its first essentially vertical position in the standby state or open position for the sealing apparatus 10, which then is ready to receive another new package 20 for another sealing procedure.

The vertical bars 122, 124, 132, 145 and the locking plate 230 and distance plate 250 shown in figs. 2-4 are made of metal, and the horizontal bars 125, 134, 142, 143 shown in figs. 2-4 are made of rigid and bearing grade plastic, so that these bars when sliding against each other experience a low as possible friction and that the risk of having material from each bar coming loose is eliminated. The triangular couplings 126, 135, and 144 shown in figs. 2-4 are also made of rigid and bearing grade plastic for the same reason.

The horizontal bars 125, 134, 142, 143 shown in figs. 2-4 are attached to their associated vertical bars and triangular couplings, the same goes for the associated ends of the tie rods 128, 139, 191, 192, and 193, by metal pins having their ends mounted flush or ending a distance from the outer surface of each bar so that the pins do not come in contact with any other metal

surface, e.g. the locking plate 230 or distance plate 250. Moreover, the size and length of the bars and the position of their attachment points are adapted in a way that each pin end when moving with its associated bars during operation of the sealing apparatus 10 does not pass or comes near any metal surface for reducing metal to metal contact. The same goes for the associated ends of the tie rods.

CLAIMS

1. An apparatus (10) for sealing a package (20) having an open end (20a), the apparatus comprising at least one pair of halves (190, 200), which are reciprocally movable between an open position and a closed sealing position for sealingly closing the open end of the package,

c h a r a c t e r i z e d in that the apparatus (10) further comprises a pair of forming flaps (270), each forming flap being associated with a sealing jaw (190, 200) and pivotally attached at a first end (270a) to a support (170a, 180a) such that a second end (270b) of each forming flap (270) is adapted to at least partly follow the reciprocal movement of the associated sealing half (190, 200), and

in that the forming flaps (270) during the movement of the sealing halves (190, 200) towards the closed sealing position press two opposing portions of the package (20) towards each other.

2. An apparatus (10) according to claim 1, wherein each of the forming flaps (270) is adapted to be pivoted from a first essentially vertical position to a second angled position in which the second end (270b) is in contact with a portion adjacent the open end (20a) of each package (20).

3. An apparatus (10) according to claim 2, wherein each of the forming flaps (270) is biased, such that it is kept in its first essentially vertical position when the sealing halves (190, 200) are in their open position.

4. An apparatus (10) according to claim 1, wherein the apparatus (10) comprises sealing means (40) comprising at least three pairs of linkage arrangements including a first pair of linkage arrangements (120) with

two reciprocally movable halves (150, 160) for pressing on opposing portions of the package at a distance from the open end thereof, a second pair of linkage arrangements (130) with two reciprocally movable halves (170, 180) for gripping each package adjacent the open end thereof, and a third pair of linkage arrangements (140) with two reciprocally movable halves (190, 200) for closing and sealing the open end (20a) of each package (20).

5. An apparatus (10) according to claim 4, wherein each of the forming flaps (270) is attached at its first end (270a) to one end (170a, 180a) of each half (170, 180) of the second pair of linkage arrangements (130) between the third pair of linkage arrangements (140) and the second pair of linkage arrangements (130).

6. An apparatus (10) according to claim 3, wherein each of the forming flaps (270) is biased by means of a spring (280), which is operatively connected to the first end (270a) of each of the forming flaps.

7. An apparatus (10) according to claim 5, wherein each of the forming flaps (270) is attached at its first end (270a) to an upper side (170a, 180a) of each half (170, 180) of the second pair of linkage arrangements (130).

8. An apparatus (10) according to claim 1, wherein each of the forming flaps (270) is generally T-shaped and oriented such that the second end (270b) of the flap (270) forms the overhead horizontal leg of the T.

9. An apparatus (10) according to claim 1, wherein wherein each of the forming flaps (270) is generally T-shaped and oriented such that the first end (270a) of the flap (270) forms the vertical leg of the T.

10. An apparatus (10) according to claim 4, wherein the three pairs of linkage arrangements (120, 130, 140) for sealingly closing the open end (20a) of each package (20) are vertically spaced apart, so that the movable halves (150, 160, 170, 180, 190, 200) of the linkage arrangements are freely movable in relation to each other during sealing and closing of each package.

11. An apparatus (10) according to claim 10, wherein the vertical distance between the three pairs of linkage arrangements (120, 130, 140) is adjustable.

12. An apparatus (10) according to claim 10, wherein the third pair of linkage arrangements (140) with two halves (190, 200) for sealingly closing the open end (20a) of each package (20) is placed at a vertical distance from each half (170, 180) of the second pair of linkage arrangements (130), which vertical distance is adapted so that the flap (270) is pivoted by the two halves of the third pair of linkage arrangements from its first essentially vertical position to its second angled position for pressing two opposing portions of the package towards each other.

13. An apparatus (10) for sealing a package (20) having an open end (20a), comprising:

- at least one sealing means (40) for sealingly closing the open end comprising at least one pair of sealing halves (190, 200),
- at least one actuation arrangement (60, 64, 65, 66, 67, 68, 69, 128, 139, 191, 192, 220),
- the sealing means and the at least one actuation arrangement being operatively connected to each other, and
- the at least one sealing means (40) comprises at least one sealing device (90),

characterized in that the at least one sealing device (90) comprises at least three pairs of linkage arrangements including a first linkage arrangement (120) for pressing on opposing portions of the package (20) at a distance from the open end (20a) thereof, a second linkage arrangement (130) for gripping each package, and a third linkage arrangement (140) for sealingly closing the open end.

14. An apparatus (10) for sealing a package (20) according to claim 13, wherein each pair of linkage arrangements (120, 130, 140) comprises two movable package-engaging link halves (150, 160, 170, 180, 190, 200) placed opposite each other, each half being rotatably attached to a frame (80) of the sealing apparatus (10) and operatively connected to the at least one actuation arrangement (60, 64, 65, 66, 67, 68, 69, 128, 139, 191, 192, 220).

15. An apparatus (10) for sealing a package (20) according to claim 14, wherein each link half (150, 160, 170, 180, 190, 200) has a shape corresponding to a vertical leg (122, 132, 145) pointing upwards with a first upper package-engaging end (122a, 132a, 145a) having an foot-like shape, and a second lower end (122b, 132b, 145b) rotatably attached to the frame (80).

16. An apparatus (10) for sealing a package (20) according to claim 14, wherein each of the movable package-engaging link halves (170, 180) of the second linkage arrangement (130) for gripping each package (20) has a package-engaging member (131) in the form of a U-shaped grip member that is adapted to grasp each package from the opposite side in relation to the other corresponding opposite package-engaging member.

17. An apparatus (10) for sealing a package (20) according to claim 16, wherein each of the two package-engaging members (131) of the second linkage arrangement (130) is provided with a forming flap (270) having a first end (270a), which is pivotally attached to one end (170a, 180a) of the second linkage arrangement (130), and a second free end (270b).

18. An apparatus (10) for sealing a package (20) according to claim 17, wherein each of the forming flaps (270) is adapted to be pivoted from a first essentially vertical position to a second angled position in which the second end (270b) is in contact with a portion of each package (20) adjacent the open end (20a) thereof.

19. An apparatus (10) for sealing a package (20) according to claim 18, wherein each of the forming flaps (270) is generally T-shaped and oriented such that the second end (270b) of the flap (270) forms the overhead horizontal leg of the T.

20. An apparatus (10) according to claim 17, wherein each of the forming flaps (270) is generally T-shaped and oriented such that the first end (270a) of the flap (270) forms the vertical leg of the T.

21. A method for sealing a package (20), which method uses the apparatus (10) according to claim 1,

c h a r a c t e r i z e d by the steps of

providing the apparatus (10) with a pair of forming flaps (270),

setting the apparatus (10) in a first open package-receiving position,

supplying a package (20) to the apparatus (10),

associating each forming flap (270) with a sealing half of at least one pair of reciprocally movable sealing halves (190, 200),

moving the at least one pair of reciprocally movable sealing halves (190, 200) of the apparatus (10) towards and into contact with the package (20),

pressing two opposing portions of the package (20) towards each other by means of the pair of forming flaps (270) during the movement of the at least one pair of reciprocally movable sealing halves (190, 200),

biasing the at least one pair of sealing halves (190, 200) further by pressing against opposing portions (20a) of the package (20), thereby

folding the opposing portions (20a) of the package (20), and

sealing the package by supplying energy to the at least one pair of reciprocally movable sealing halves (190, 200).

22. A method for sealing a package (20) according to claim 21, comprising the additional steps of:

pivotally attaching each of the forming flaps (270) at a first end (270a) to a support (170a, 180a), whereby a second end (270b) of each of the forming flaps at least partly follows the associated half of the at least one pair of reciprocally movable sealing halves (190, 200).

23. A method for sealing a package (20) according to claim 21, comprising an additional step of:

pivoting the forming flaps (270) from a first essentially vertical position to a second angled position in which the second end (270b) is in contact with a portion of each package (20) adjacent an open end (20a) thereof.

24. A method for sealing a package (20) according to claim 23, comprising the additional steps of:

biasing each of the forming flaps (270), thereby pivoting it into its first essentially vertical position and keeping it in its first essentially vertical position

when the associated sealing half of the at least one pair of reciprocically movable sealing halves (190, 200) is in its open position.

25. A method for sealing a package (20) having an open end (20a),

c h a r a c t e r i z e d by the steps of

sealingly closing the open end (20a) of the package (20) by using at least one sealing equipment (40) having at least one pair of sealing halves (190, 200),

providing the apparatus (10) with at least one actuation arrangement (60, 64, 65, 66, 67, 68, 69, 128, 139, 191, 192, 220),

operatively connecting the sealing equipment (40) and the at least one actuation arrangement (60, 64, 65, 66, 67, 68, 69, 128, 139, 191, 192, 220),

providing the at least one sealing equipment (40) with at least one sealing device (90), and

providing the at least one sealing device (90) with at least three pairs of linkage arrangements including a first linkage arrangement (120) for pressing on opposing portions of the package (20) at a distance from the open end (20a) thereof, a second linkage arrangement (130) for gripping each package, and a third linkage arrangement (140) for sealingly closing the open end of the package.

26. A method according to claim 25, wherein the method uses an apparatus (10) according to claim 13.

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ABSTRACT

An apparatus 10 for sealing packages 20 is to be mounted as a part of a larger packaging machine, which fills packages 20 with products or substances, preferably food or beverages but could be any other suitable substance, then closes and seals the packages using the sealing apparatus 10 by folding each package transversally, thereby closing it and sealing the transversal fold, and subsequently delivers the packages to a final folding station.

To be published with fig. 1.

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FIG 1

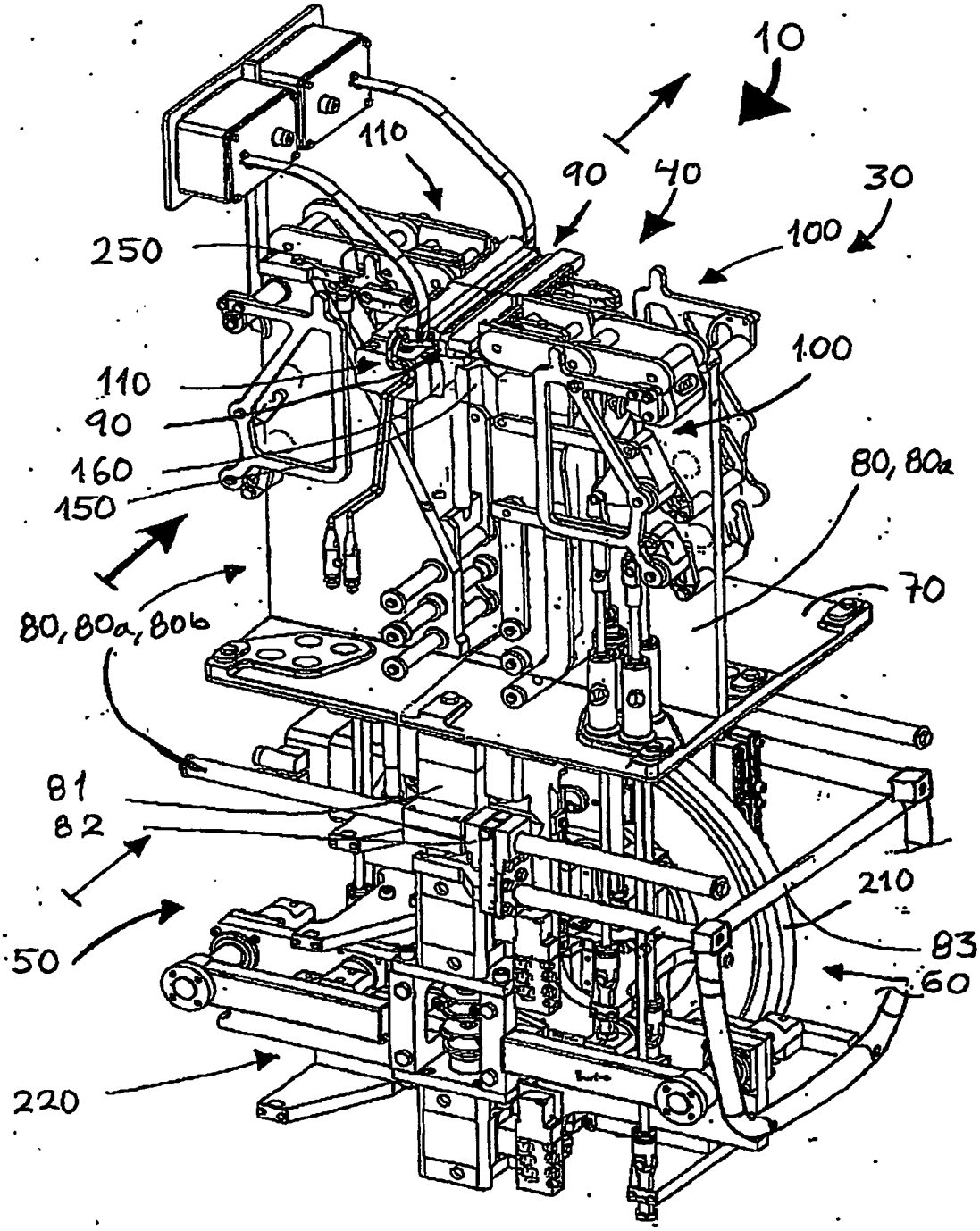
10
110
90
40
30
250
100
100
110
90
160
150
80, 80a
70
80, 80a, 80b
81
82
210
83
50
60
220

FIG 2

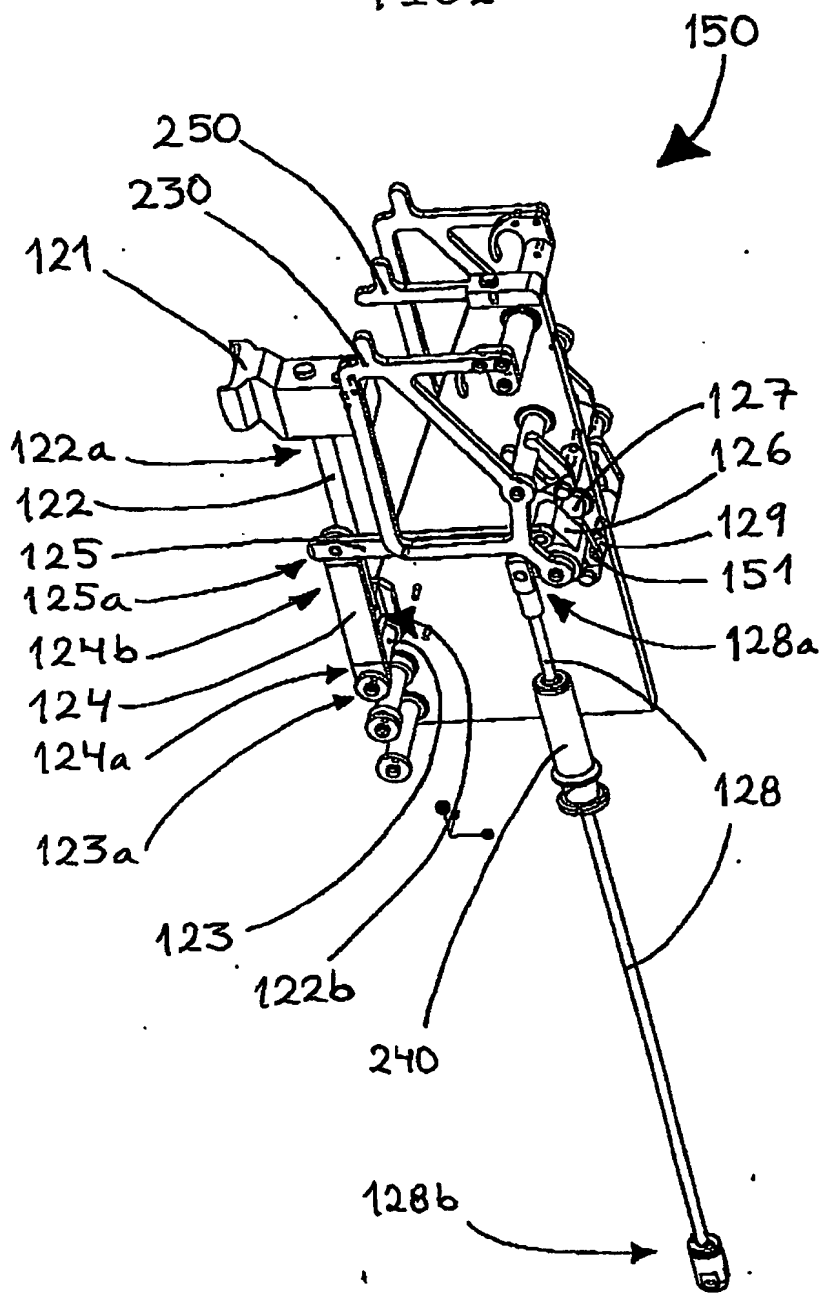
150
250
230
121
127
122a
126
122
129
125
151
125a
128a
124b
124
124a
128
123a
123
122b
240
128b

FIG 3

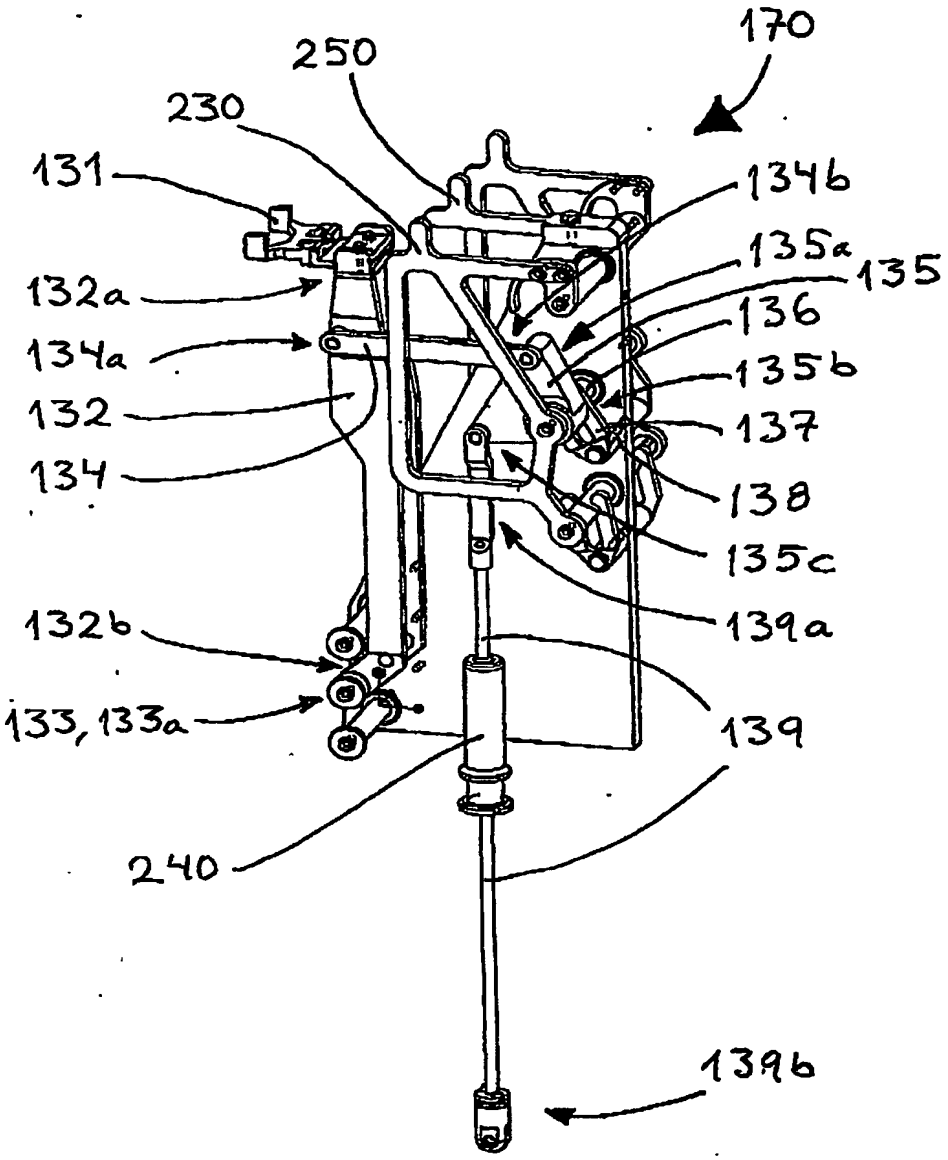
170
250
230
131
1346
135a
135
132a
136
134a
135b
132
137
134
138
135c
139a
132b
139
133, 133a
240
1396

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FIG 4

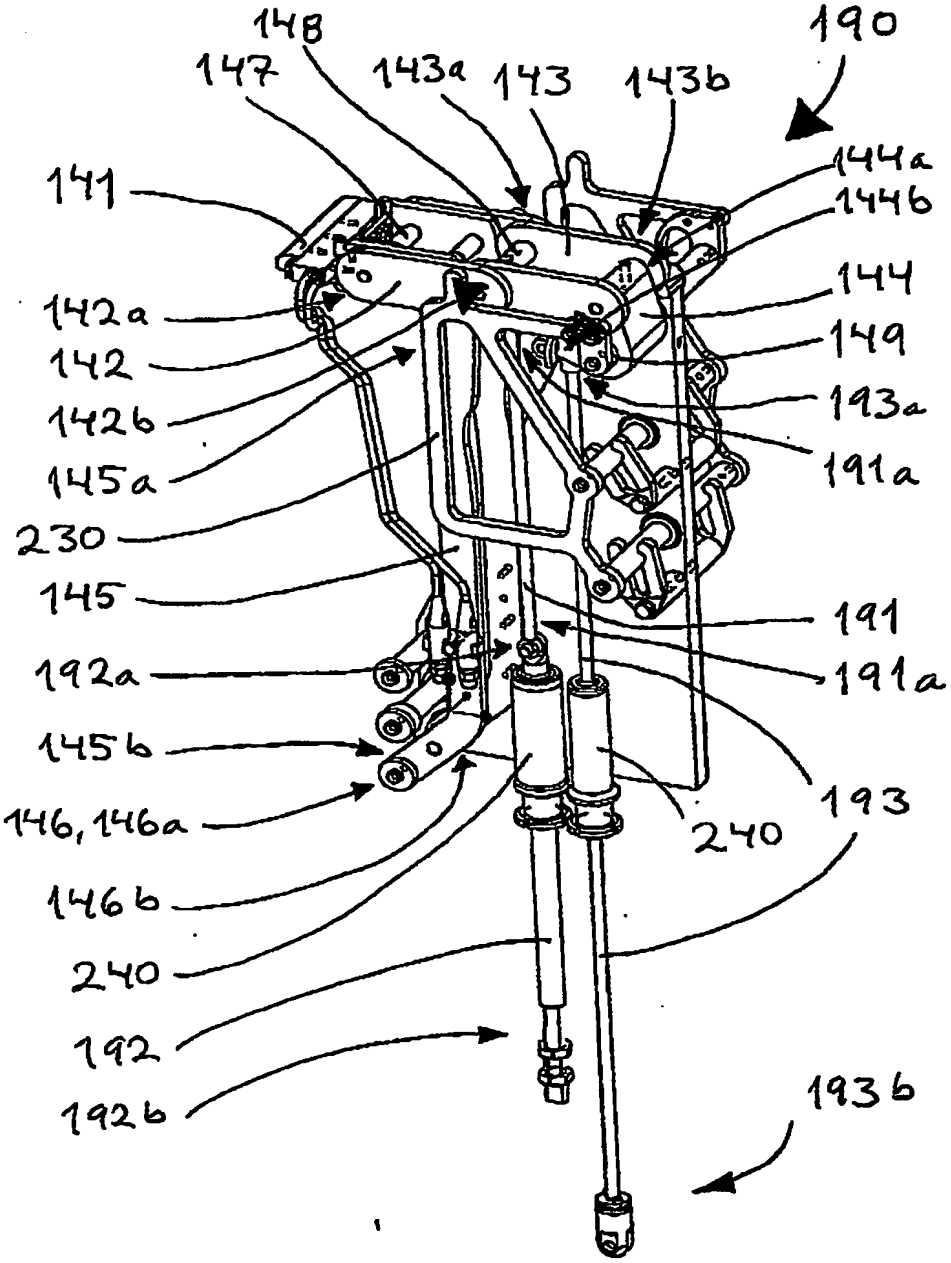
148
147
143a
143
143b
190
144a
144b
141
144
142a
149
142
193a
142b
191a
145a
230
145
191
192a
191a
145b
193
146, 146a
240
146b
240
192
193b
192b

FIG 5

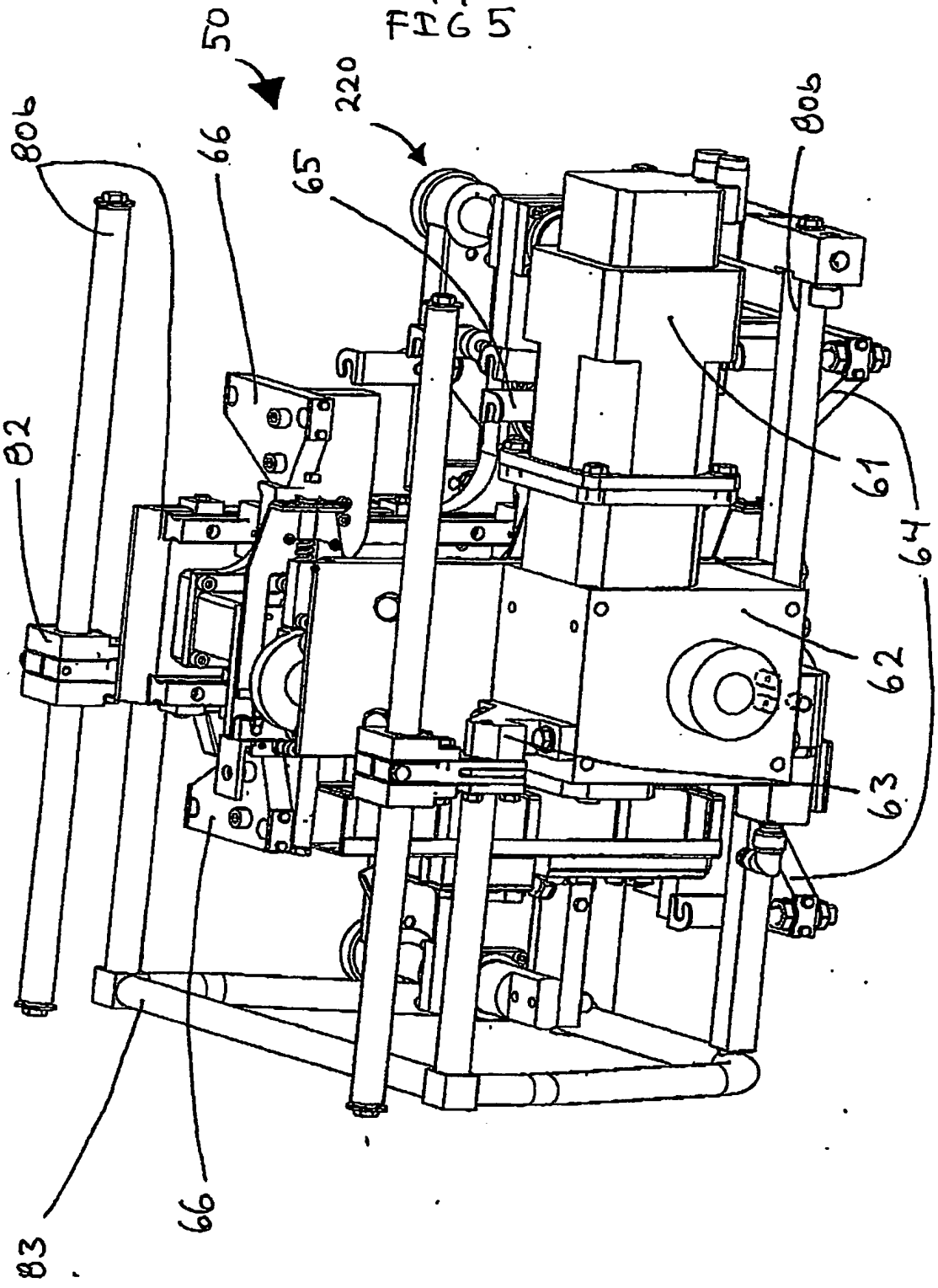

FIG 6

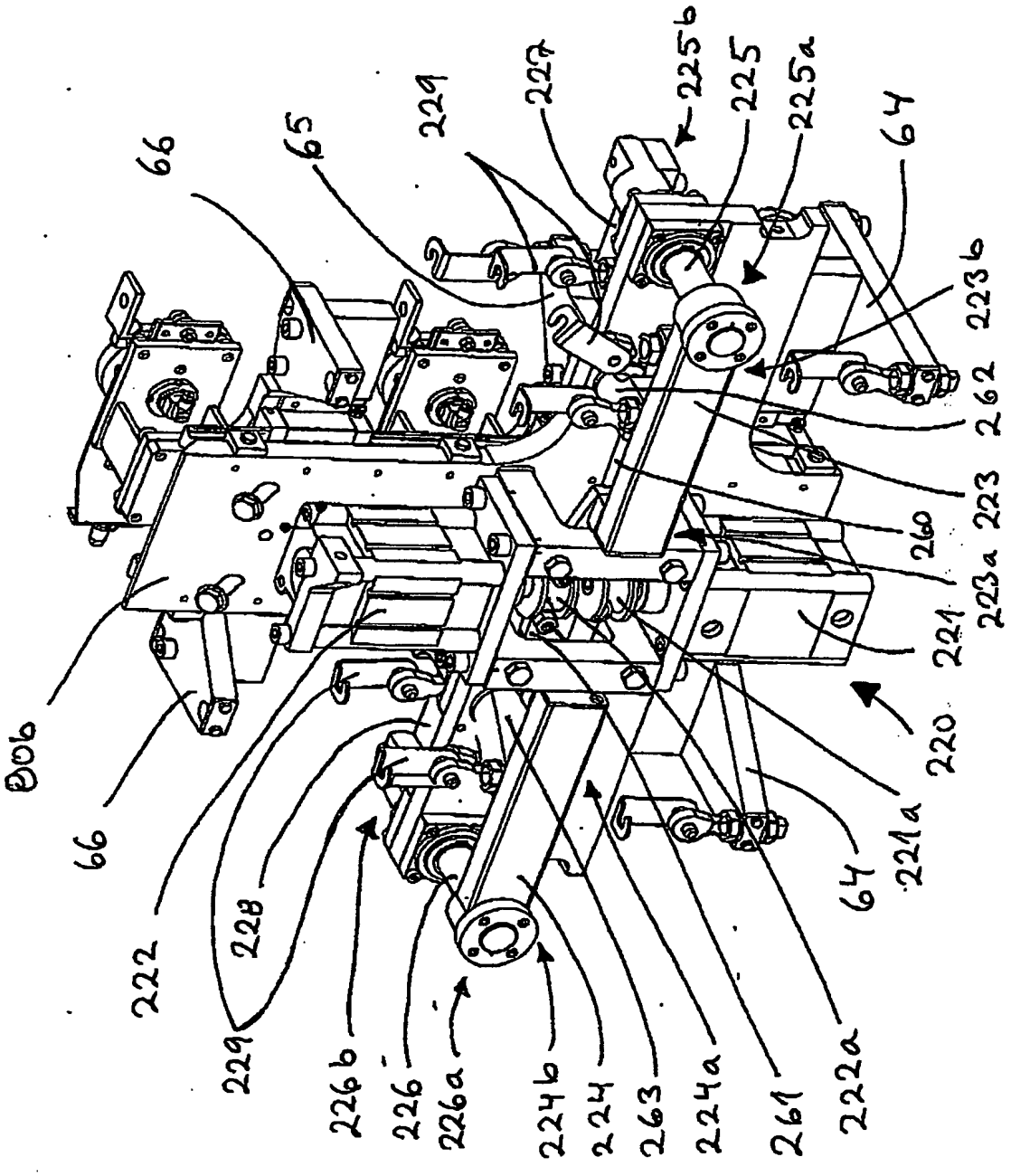

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FIG 7

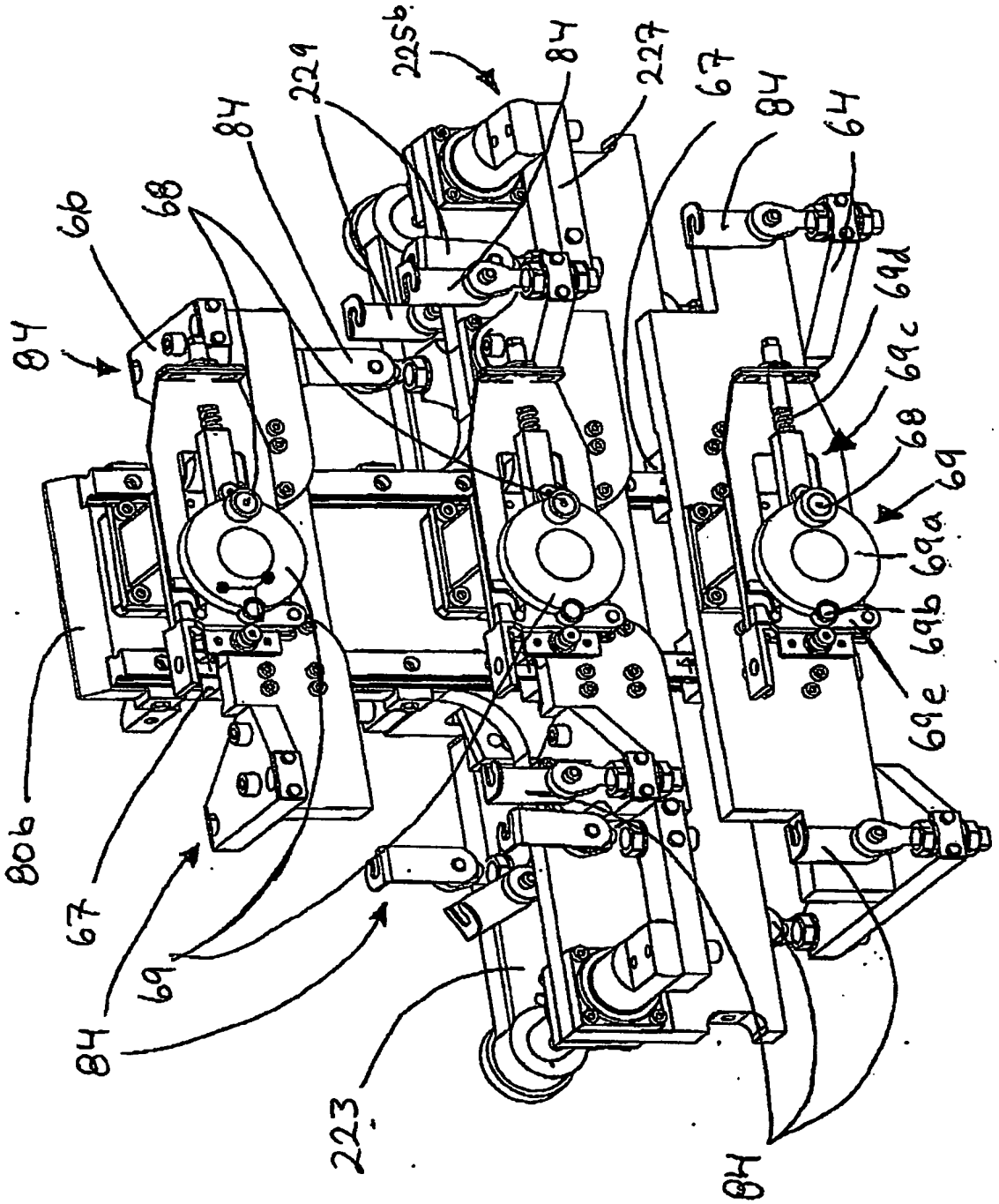

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FIG 8

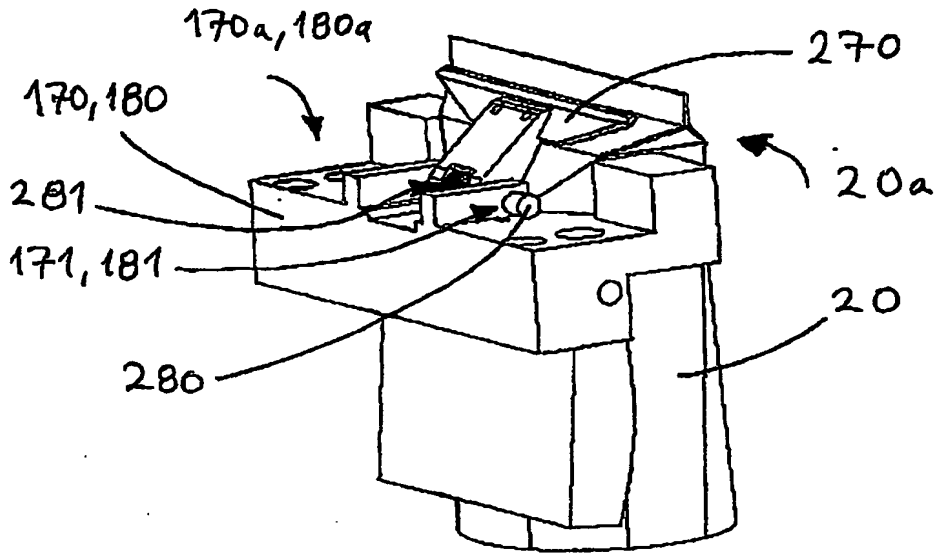
170a,180a
270
170,180
20a
281
171,181
20
280

FIG 9

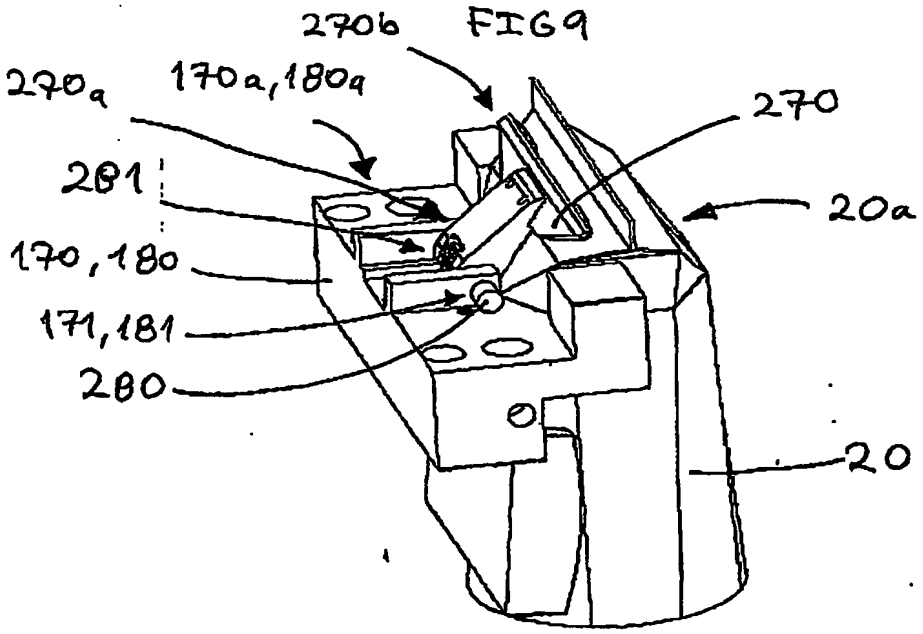
270b
270a
170a,180a
270
281
20a
170,180
171,181
280
20

FIG 10